

Figure S1 Design diagram of flow cell unit

Table S1 Key characteristics of the flow cells used in the study

<b>Parameter</b>	<b>Value</b>
<b>Material</b>	Acrylic
<b><math>k_s</math></b>	0.009 mm
<b>Hydraulic diameter</b>	2.44 cm
<b>Flow area</b>	6.28 cm <sup>2</sup>
<b>Wetted perimeter</b>	10.28 cm
<b>Hydraulic radius</b>	0.61 cm
<b>Length</b>	100 cm
<b>Internal volume</b>	628.3 cm <sup>3</sup>
<b>Volume/Area</b>	100 cm
<b>Biofilm sampling points</b>	5
<b>Biofilm sampling area</b>	3.14 cm <sup>2</sup>

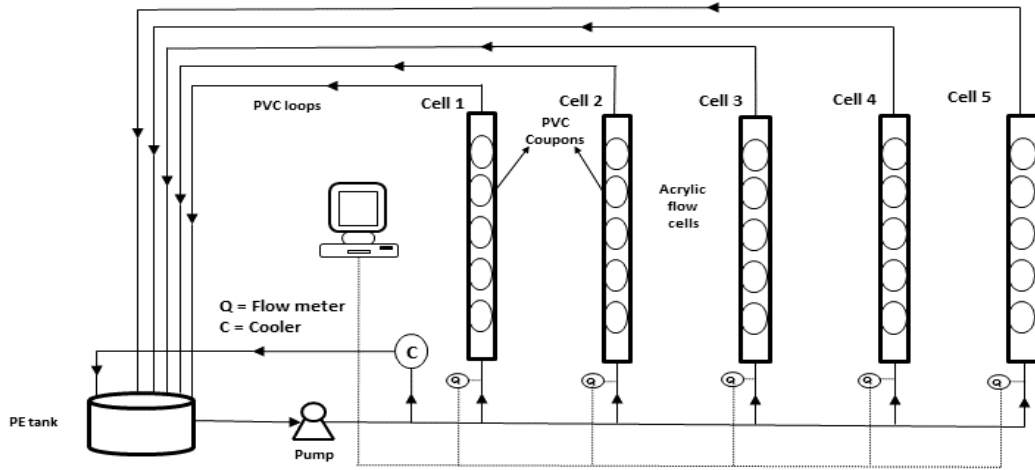


Figure S2 Schematic diagram of the flow cells during nitrification and biofilm development stage

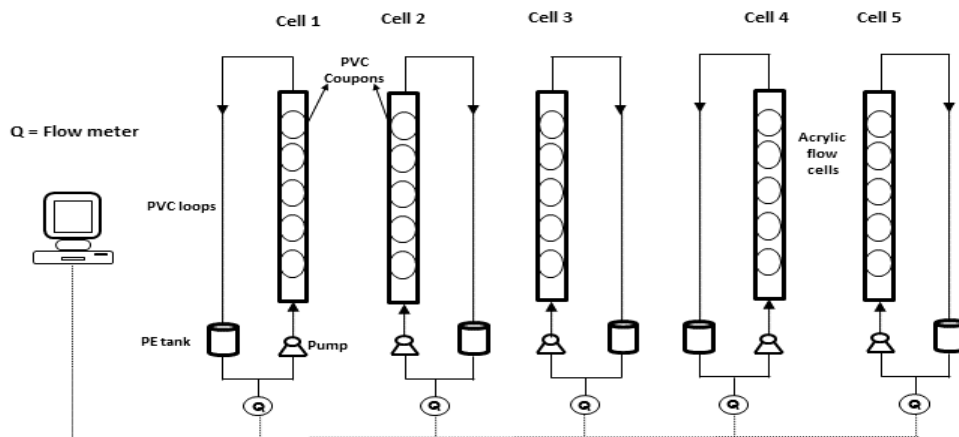


Figure S3 Schematic diagram of the flow cells during testing phases

Table S2 Dissolved oxygen(mg/L) monitored in flow cells during test phase 1 & 2

Test phase 1						Test phase 2					
Time (day)	Flow cell					Time (day)	Flow cell				
	10L/min	8L/min	6L/min	4L/min	2L/min		10L/min	8L/min	6L/min	4L/min	2L/min
0	8.45	9.44	9.59	9.1	9.18	0	8.59	8.84	8.74	8.62	8.63
1	10.15	10.08	10.39	9.9	9.56	3	8.64	8.29	7.97	8.49	8
3	10.35	9.66	9.49	9.97	9.32	6	8.65	8.56	8.58	8.89	8.68
6	10.62	9.83	10.48	11.77	9.91	9	9.6	8	9.09	8.48	8.74
9	10.02	9.87	10.37	9.29	10.31	10	9.38	8.69	8.77	7.86	8.83
10	8.92	10.51	9.46	8.85	8.79	11	9.62	8.92	9.14	8.79	9.07
11	10.39	11.92	9.71	10.45	9.84	12	9.56	8.87	8.64	8.97	9.35
12	10.98	10.82	10.79	11.66	10.69	13	10.71	9.14	9.16	9.65	10.06
13	10.24	8.89	9.78	9.09	9.04	14	9.98	9.27	9.11	8.78	9.63
14	9.16	9.12	8.85	9.3	9.23	15	9.52	8.76	8.56	8.39	8.8
15	8.98	8.68	8.97	8.46	8.48	16	8.49	8.31	8.8	8.91	7.63
16	8.21	8.46	8.6	9.23	8.98	18	10.5	8.86	9.87	10.02	8.97
18	9.77	9.05	8.2	9.23	9.27	21	10.16	9.83	9.41	9.58	8.87
21	10.42	9.09	9.27	8.68	9.34	24	9.51	11.32	9.79	9.62	8.56
24	10.7	9.82	9.28	9.5	9.23	27	11.89	8.93	10.39	9.62	9.61
27	9.87	10.54	10.58	9.44	10.21	30	10.75	9.2	10.42	9.57	9.79
30	9.78	8.72	9.66	10.25	9.7	33	10.84	8.93	8.94	7.94	9.32
33	9.43	8.65	8.7	8.76	8.54	39	8.86	7.6	7.12	7.72	8.14

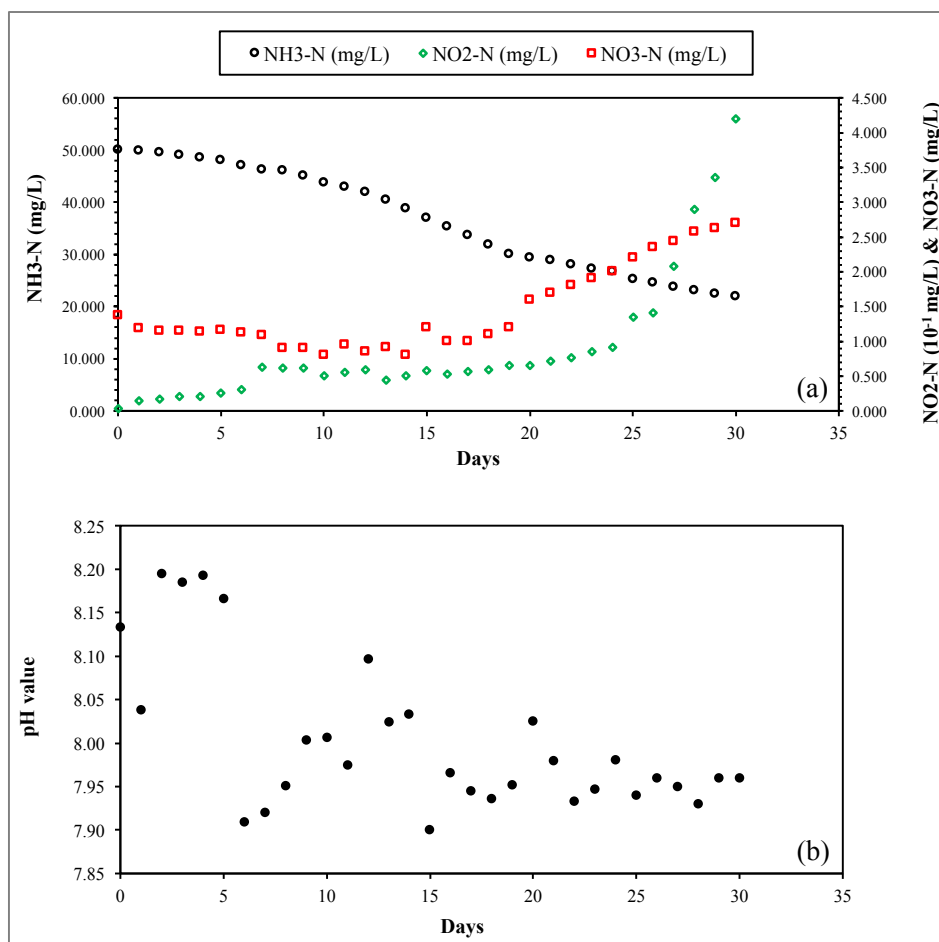


Figure S4. Water physico-chemical parameters monitored during pre-grow stage. (a) Nitrification episodes, including the concentration of ammonia nitrogen, nitrate nitrogen and nitrite nitrogen; (b) pH value.

Table S3 Data of Qubit DNA concentration and DNA quality

Sample name	Qubit concentration ng/ $\mu$ l	DIN
2L_B1	59.8	6.3
2L_BW1	238	6.9
4L_B1	17.5	6.6
4L_BW1	480	1
6L_B1	42.8	6.4
6L_BW1	1000	1
8L_B1	5.63	6.4
8L_BW1	593	6.4
10L_B1	5.99	6.2
10L_BW1	567	4.1
2L_B2	228	4.4
2L_BW2	161	7.4
4L_B2	102	1
4L_BW2	340	6.3
6L_B2	236	1
6L_BW2	585	6
8L_B2	39.9	4.1
8L_BW2	367.5	1
10L_B2	70.4	6
10L_BW2	1000	6.3

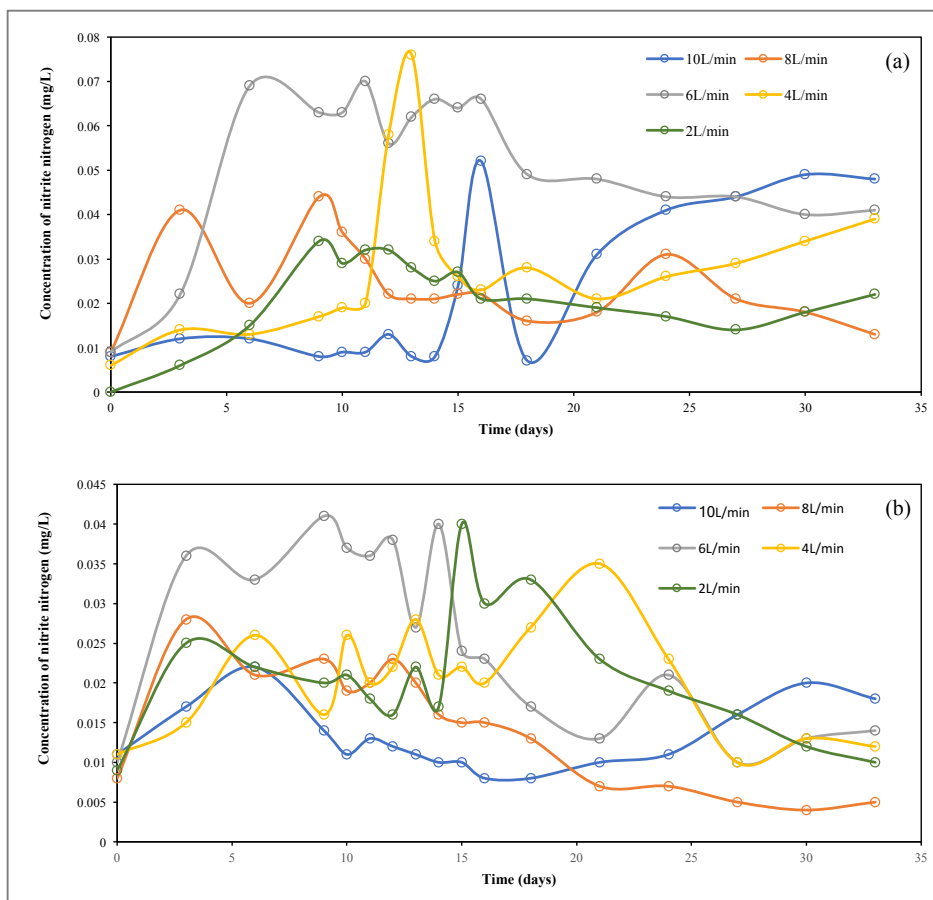


Figure S5. The concentration of nitrite nitrogen monitored in different flow cell units. (a) Test phase 1; (b) Test phase 2.